

Patent Claims

1. A photovoltaic solar cell with an electric solid material contact between a semiconductor layer of layer thickness d_{HL} and a plurality of metal nano emitters each of a space-charge zone of extent w within the semiconductor layer and embedded in an electrically insulating oxide layer applied on the semiconductor layer, with minority carriers migrating to the space-charge zone over a diffusion length L , and with a transparent conductive layer electrically insulated from the semiconductor layer by the oxide layer, as well as with front and rear contacts, characterized by the fact that the metal nano emitters (NE) are structured aciculary or in a rib-like manner and are separated from each other by a uniform distance $D \leq \sqrt{2}L$ and penetrate into the semiconductor layer to a depth $T \geq d_{HL} - \frac{L}{2} + w$.
2. The photovoltaic solar cell in accordance with claim 1, characterized by the fact that the metal nano emitters (NE) in the semiconductor layer (HL) are provided with lateral branches and/or extend obliquely in the semiconductor layer (HL).
3. The photovoltaic solar cell in accordance with claim 1 or 2, characterized by the fact that a reflective surface is applied to the rear surface of the semiconductor layer (HL) in front of the rear contact (RK).
4. The photovoltaic solar cell in accordance with one of claims 1 to 3, characterized by the fact that an antireflective layer is applied to the transparent conductive layer (TCO).
5. A method of fabricating a photovoltaic solar cell with an electric solid material contact between a semiconductor layer of a layer thickness of d_{HL}

and a plurality of metal nano emitters each having a space-charge zone of the extent w and embedded in an electrically insulating oxide layer arranged on the semiconductor layer, minority carriers migrating to the space-charge zone over a diffusion length L , and a transparent conductive layer electrically insulated from the semiconductor layer by the oxide layer, as well as with front and rear contacts, the nano emitters being acicularly structured and separated from each other by a uniform space $D \leq \sqrt{L^2}$ and having a depth of penetration $T \geq d_{HL} - \frac{L}{2} + w$, particularly in accordance with claim 1 or 2, characterized by the process steps:

- 10 • wet-chemical or electrochemical or photo-electrochemical application of an electrically insulating oxide layer (OS) of high electronic quality on a semiconductor layer (HL);
- structuring the oxide layer (OS) by point-like or linear removal of the oxide layer (OS) at the locations provided for applying the nano emitters (NE);
- 15 • wet-chemical or electrochemical or photo-electrochemical acicular or rib-like etching of the structure in the oxide layer (OS) down into the semiconductor layer (HL);
- light-induced or potential-controlled electrochemical precipitation from a redox electrolyte of metal into the structure in the oxide layer (OS) and into the semiconductor layer (HL);
- 20 • wet-chemical or electrochemical or photo-electrochemical application of a transparent conductive layer (TCO) on the oxide layer (OS); and
- application of front and rear contacts (FK, RK).

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6. The method in accordance with claim 5, characterized by a wet-chemical or electrochemical or photo-electrochemical structuring of the oxide layer (OS) so that the fabrication process of the solar cell (SZ) is executed continuously in a wet-chemical or electrochemical or photo-electrochemical manner at a low temperature range.

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7. The method in accordance with claim 5,
characterized by
structuring the oxide layer (OS) by scanning probe microscopy.

5 8. The method in accordance with claim 7,
characterized by
parallel embossing of a plurality of indentations for structuring a large-surface
oxide layer (OS).

10 9. The method in accordance with one of claims 5 to 8,
characterized by
potential, current and charge-controlled application of an electrically insulating
anodic oxide layer on the structure of the semiconductor layer (HS) prior to
metal precipitation.

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10. The method in accordance with one of claims 5 to 9,
characterized by
applying a reflective layer to the rear surface of the semiconductor layer (HL)
and/or an antireflection layer on the transparent conductive layer (TCO).

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